the results we have obtained by our present method with those which had been previously ascertained by the graphic method, and so introduce the description of the facts which we have discovered, elucidating the physiology of the spinal cord, both in its relation to the higher centres, and to the peripheral nerves.

2. *Experimental Procedure.*

The observations were in all cases made on etherized animals (cat and monkey), with due regard to the special influence of the anæsthetic. The operative procedure was so designed as to provide for suitable exposure of a particular region of the nervous system for excitation, and of another part in which the electromotive changes evoked by the stimulation may be observed. The relative parts were as follows :—

Part exposed for excitation.	Part exposed for observation.
Brain (cortex and corona radiata)	and spinal cord.
,, ,, ,,	and mixed nerve.
Spinal cord	and spinal cord.
,,	and mixed nerve.
Mixed nerve	and spinal cord.
Spinal roots	,, ,,
Posterior roots	and mixed nerve.

The excitation was either electrical, chemical (*i.e.* with absinthe and strychnine), or mechanical. In the former instance the duration and intensity were specially determined. The records were made by a Thomson high-resistance reflecting galvanometer and a Lippmann's mercurial capillary electrometer.

The tissue, whether nerve or spinal cord, was so arranged for observation as to be always suspended in the air, one end remaining in connection with the animal; consequently any error due to current derivations from the rest of the body could only have a slight and unipolar effect.

3. *Resting Electrical Difference between the Cut Surface of the Tissue and its Uninjured Longitudinal Surface.*

The average amounts of this difference in the tissues observed were as follows :—

	Cat.	Monkey.
Nerve (69 cases),	0·01 Daniell	(12 cases), 0·005 Daniell.
Root (5 cases),	0·025 ,,	—
Cord (50 cases),	0·032 ,,	(9 cases), 0·022 ,,

We have observed that the cord difference is greater when that tissue is in connection with the higher centres, and that it rises after each excitation. An important fall of the difference is to be remarked in all three tissues as a direct result of systemic death.

4. *Electrical Changes in the Spinal Cord evoked by Excitation of the Cortex Cerebri and Corona Radiata.*

We further discuss in our full paper the following points additional to those described in our previous communication, and which have resulted from the observation of the above changes :—

(*a*) Localization of cortical areas of representation in relation to the various regions of the cord.

(*b*) Bilaterality of representation in the central nervous system, as evidenced by the electrical changes in the two halves of the spinal cord, consequent upon excitation of the brain or cord.

5. *Electrical Changes in the Spinal Cord when evoked by Direct Excitation of its Fibres, after Severance from the Encephalon.*

We have by employment of this method ascertained the proportionate existence of direct channels in the various columns of the spinal cord, our design embracing the quantitative comparison of the electrical changes (and so indirectly of the nerve-impulses) which are transmitted as a result of minimal excitation of the fibres. To further control our observations on these points, we have also determined the extent of interruption in any given channel by intervening sections of the same.

As an extension of this subject, we have investigated the concurrent spread of nervous impulses to collateral paths, and probably to centres, when this further condition is introduced by increase in the stimulus.

The above results have been obtained in the case of both ascending and descending impulses.

Among other general conclusions from this division of our research are the following :—

(1) High degree of unilaterality of representation in the spinal cord.

(2) Spread of impulses from one posterior column to another and from one posterior column to its neighbouring lateral column through centres.

6. *The Relation of the Paths and of the Bulbo-Spinal Centres in the Spinal Cord to the Peripheral Nerves and their Roots.*

We have investigated this important relationship in the following modes :—

(I.) *The Electrical Changes in the Spinal Cord evoked by Excitation of a Mixed Nerve or its Roots.*—The chief conclusions which have been deduced from the results of these experiments, by means of minimal excitation and the employment of the method of blocking by intervening sections, include the following :—

(1) Complete obstruction offered to centripetal impulses reaching the cord by the central end of the anterior root.

(2) Mode of conduction, direct and indirect, in the cord of centripetal impulses passing up the posterior root.

(3) Localization of the direct path of afferent impulses in the posterior column of the same side as that of the nerve or root excited.

(4) Localization of the indirect path of afferent impulses in the posterior columns of the same and the opposite side and the lateral column of the same side as that of the nerve excited.

(5) Proportionate development of both systems of paths in the two sides of the cord.

Expressed in percentages of the total transmission, this proportion is as follows :—

Posterior column of same side as the excited nerve	60 p.c.
Lateral column of same side as the excited nerve	20 ,,
Posterior column of opposite side to the excited nerve	15 ,,
Lateral column of opposite side to the excited nerve	5 ,,

(II.) *The Electrical Changes in a Mixed Nerve or its Roots evoked by Excitation of the Spinal Cord.*—Whereas in the foregoing series (I.) we dealt only with ascending impulses, we proceeded to investigate the distribution of descending impulses by observing the above-named changes when the individual columns of the cord are excited by minimal and later with more intense stimuli, controlling our results by the method of intervening sections.

We can summarize the effects observed as follows :—

(1) Marked quantitative diminution suffered by impulses leaving the spinal cord by the anterior roots, whether originating in the cortex cerebri, corona radiata, or the lateral columns of the cord.

(2) Localization of direct transmission of impulses in the posterior column and passing out into the posterior roots of the same side.

(3) Proportionate development of the direct and indirect paths in the individual columns of the cord, passing out into the mixed nerve of the one side.

(4) Effects observed in the posterior roots when the bulbo-spinal centres are excited either by strychnine or electrically (kinæsthesis).

Finally, the chief general principles elucidated by this research may be stated as follows :—

(1) Unilateral character of the representation of function in the paths of the central nervous system.

(2) The physiological characteristics of the regions of a nerve centre :—

(*a*) The kinæsthetic activity of the afferent region of the centre.

(*b*) The obstruction offered by the efferent region, including the field of conjunction, to the transmission of impulses through the centre.

THE CITY AND GUILDS OF LONDON INSTITUTE.

AN important memorandum on the examination, inspection, and payment of grants in aid of local technological and trade classes has been issued by the City and Guilds of London Institute to County Councils and municipal bodies. So many changes are likely to be effected by means of the funds which

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have lately been granted to local authorities for the promotion of technical education, that it was necessary for the Institute to consider the various ways in which it might hope to meet most effectually the altered conditions. In the following statement it has summed up clearly the main facts of the situation :—

(1) Recent legislation has placed funds at the disposal of County Councils for the purposes of technical education, and has imposed on local authorities the responsibility of determining the best means of utilizing those funds in accordance with the provisions of the Technical Instruction Act.

(2) Whilst the Science and Art Department pays grants on results on all subjects of instruction included in its Directory, no such payments are made by the Department on the technological and trade subjects included in the Institute's programme. Hitherto, grants on such subjects have been paid by the Institute, but these grants will be discontinued after the year 1892.

(3) The Institute is prepared to continue, and to defray the cost of its present system of technological examinations, and to improve it from time to time—

(*a*) By the addition of further practical tests.

(*b*) By adapting the examinations to a still greater extent to local requirements and to the different sections into which many trades are now divided.

(*c*) By the addition of new subjects of examination.

(4) The administration of the present system of examinations involves—

(*a*) The organization of technical classes adapted to different trades.

(*b*) The selection and appointment of competent examiners and local superintendents.

(*c*) Inquiry into the qualifications, and the registration, of teachers.

(*d*) The preparation of syllabuses of instruction and examination.

(*e*) The recommendation, of books of reference, for the use of students and for the formation of technical libraries in connection with separate trades.

(*f*) The examination of registers of attendance of students at classes, and of certificates as to their occupations.

(*g*) The award of different grades of certificates, of silver and bronze medals, and of the money prizes, provided by the separate Livery Companies of London.

(5) The present system of examinations would be further improved by the inspection of classes by competent experts in different branches of trade, and by other persons possessing the necessary scientific knowledge and educational experience. Information might thus be obtained as to the efficiency of the teaching, the provision made for practical instruction in the laboratory or workshop, and the adequacy of the equipment as regards apparatus, models, and machinery. The Institute has under consideration the expediency of organizing such a system of inspection.

(6) The Institute would be prepared to submit to County and Borough Councils co-operating with it, reports on the attendance of students at technological classes, and on the results of the examination of such students, which would serve to guide County Councils in making grants in aid of the maintenance of such classes.

(7) It is suggested that the grants in aid might be of two kinds :—

(*a*) Capitation grants on students in regular attendance at classes certified by the Institute.

(*b*) Grants on the results of the Institute's technological examinations.

(8) No grants have been hitherto given under section (*a*), although the want of such assistance has been generally felt and fully recognized. The grants under section (*b*), given by the Institute, consist of £2, and £1, on behalf of every candidate who takes a first-class or second-class certificate, and is actually engaged in the trade connected with the subject of examination.

(9) The Institute possesses the administrative machinery required for furnishing local authorities with the necessary detailed reports for the award of grants under each of the above sections, and is prepared to place its technical and educational experience at the service of County and Borough Councils for the purpose hereinbefore indicated.

(10) The Institute would be further prepared to make arrangements with County or Borough Councils co-operating with it, for submitting reports on the general efficiency of technological classes, and for affording assistance in the organization of new schools or classes for the promotion of technical education in connection with local trades and industries.

These suggestions are made with the view of indicating the position which the Institute has occupied during the last twelve years, and that which it is prepared to occupy in future, in relation to technical education throughout the country, and of enabling County and Borough Councils, if they so desire, to avail themselves of the assistance thus offered in improving, and in subsidizing, by the payment of grants, the technological and trade classes now established in the chief centres of industry, many of which, it is feared, without such help, will be unable to continue to exist.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Sir Alfred C. Lyall, K.C.B., K.C.I.E., has been appointed Rede Lecturer. His subject is "Natural Religion in India."

Prof. Roy announces for the Long Vacation a course of instruction in "Bacteriology," suitable for candidates for the University diploma in public health. Dr. A. Gamgee delivers in this term and the next a course in pathological chemistry.

The Special Board for Medicine have issued revised schedules defining the range of the examinations in physics and chemistry for the M.B. degree. Johns Hopkins University is recognized by the Board as a school of medicine.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 12.—"On the Demonstration by Staining of the Pathogenic Fungus of Malaria, its Artificial Cultivation, and the Results of Inoculation of the Same." By Surgeon J. Fenton Evans, M.B. Communicated by Prof. Victor Horsley, F.R.S. (From the Laboratory of the Brown Institution.)

The discovery of organisms constantly concomitant with manifestations of malaria was made by Laveran in 1880.

His researches have since been corroborated and amplified by numerous observers in different parts of the world, among whom must be mentioned, Marchiafava Celli, Golgi, and Guarnieri, in Italy ; Councilman, Osler, and James, in America : and Vandyke Carter, in India. The foreign structures which all of the above-named investigators agree in finding in the blood during or after attacks of ague may be grouped into the following classes :—

(1) "Cystic" bodies or spores, 2 to 11 μ in diameter, round, transparent, encapsuled bodies of variable dimensions.

(2) Crescentic bodies, 8 to 9 μ long and 3 μ broad.

(3) Plasmodia malariæ, organisms as variable in size as the "cystic" bodies or spores, possessing the power of amœboid movement, and so closely associated with the red blood corpuscle that hitherto the majority of observers have considered them to be parasites situated within the red blood cells.

(4) Mobile filaments, 21 to 28 μ long.

Despite the general concord of the observations, the subject has not advanced beyond the stage of recognition of these structures in the blood, and that, too, only while in the fresh state.

No method had hitherto been discovered of preparing permanently stained specimens of the organism.

It had never been isolated or classified, nor when thus separated had its pathogenic qualities ever been tested by experiments on lower animals.

It was thus clear that much remained to be done, and in the paper are recounted the attempts made to place the subject on a satisfactory footing. The author has found that it is possible to stain the organisms with an anilinized alkalized solution of rosanilin hydrochloride after treatment with bichromate of potash, and after treatment with dilute sulphuric acid by an anilinized alkalized solution of Weigert's acid fuchsin.

Another method of staining consisted in the saturation of the tissue with a copper salt and its reduction by sulphuretted hydrogen previous to coloration with anilinized alkalized acid fuchsin.

By these staining methods the organisms have been demonstrated in the blood, and also in the tissues. And some new, hitherto unrecognized features are described, among which may

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